80/233/DC

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

TECHNICAL COMMITTEE 80: Maritime navigation and radiocommunication equipment and systems

SHIPS AND MARINE TECHNOLOGY – HEADING CONTROL SYSTEMS FOR HIGH SPEED CRAFT (HSC), project ISO/IEC 16329

Second committee draft and compilation of comments

Document 80/196/INF contained the first committee draft on the above subject, and TC 80 members were invited to make comments. These comments were duly sent to ISO and have now been considered by the ISO/TC8/SC6 Secretariat, together with those received from the SC 6 members.

The outcome of this consideration is that a 2nd CD has now been developed by the Secretariat.

It is attached, and TC 80 members are invited to send their comments to the TC 80 Secretary by:

1999-08-01,

with copy to Central Office.

Any comments received will be collated and sent to ISO/TC8/SC 6 before the closing date for comments of 1999-08-27.

Annexes: Second committee draft, reference ISO/TC 8/SC 6 N 34 (project 16329)
Compilation of comments on first committee draft, reference ISO/TC 8/SC 6 N 30 Rev.

NOTE – The code “DC” (in 80/233/DC) stands for “Draft for comments”.

COMMITTEE DRAFT

COMMITTEE DRAFT ISO/CD 16329.2	
Date 1999 – 05 – 27	Reference number ISO/TC 8 /SC 6 N 34
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ISO/TC 8 **/SC** 6 Title Navigation Secretariat JISC/JMSA	Circulated to P- and O-members, and to technical committees and organizations in liaison for: ☐ discussion at [venue/date of meeting] ☒ comments by [date] 1999 – 08 – 27 ☒ approval for registration as a DIS in accordance with 2.5.6 of part 1 of the ISO/IEC Directives, by [date] (P-members vote only: ballot form attached) **P-members of the technical committee or subcommittee concerned have an obligation to vote.**

Title (English)

Ships and marine technology – Heading control systems for high-speed craft

Title (French)

Reference language version: ☒ English ☐ French ☐ Russian

Introductory note

This draft is prepared with the intention of creating harmony with IMO Resolution A.822(19) and ISO/DIS 11674 : Ships and marine technology – Heading control systems which is draft amendment of ISO/TR 11674:1996, and is circulated as ISO/CD 16329.2 in order to carry out the following two.

- collecting SC 6 members' opinions with regard to the contents of the draft.
- voting for or against "making the next stage of draft deliberation into the stage of having ISO/DIS 16329" .

80/233/DC

ISO/TC 8/SC 6

Date: 1999 05 27

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Ships and marine technology — Heading control systems for high-speed craft

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Contents

Foreword

Boilerplate text for ISO standards:

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standards ISO/IEC 16329 was prepared by ISO/TC 8/SC 6 and IEC/TC 80 with an aim of making it into an ISO/IEC joint standard.

Ships and marine technology — Heading control systems for high-speed craft

1 Scope

This international standard specifies the structure, performance, inspection and testing of heading control systems to be installed on board crafts operating under the following conditions.

.1 *speed exceeding 30 knots and up to 70 knots;*

.2 *maximum rate of turn 20 ° /s; and*

.3 *normal range of operation between 70 ° N and 70 ° S* shall, *as required by chapter 13 of the HSC Code, comply with the minimum performance requirements specified in these standards.*

It applies to the heading control systems which enable a craft, *to keep a preset heading with minimum operation of the* craft's *steering gear, within limits related to the* craft's *manoeuvrability in conjunction with their sources of heading information.*

The heading control systems shall, *within a speed range of up to 30 knots, comply with resolution A.342(IX), and within a speed range of 30 knots to 70 knots* shall *comply with the requirements of this resolution.*

NOTE 1 All requirements that are extracted from the recommendations of IMO Resolutions [Resolution A.822(19) on performance standards for automatic steering aids for high-speed craft, A.694(17) and A.342(IX)] are printed in italics.

NOTE 2 Heading control system has previously been called "automatic steering aids (automatic pilot)".

NOTE 3 Resolution A.342(IX) represents Resolution A.342(IX) as amended by MSC.64(67) Annex 3.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, these publications do not apply. However parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative documents referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IMO Resolution A.694(17): *General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids.*

IMO Resolution A.822(19): *Performance standards for automatic steering aids (automatic pilots) for high-speed craft.*

IMO Resolution MSC.64(67), annex 3:1997, Amendment to resolution A.342(IX) - *Performance standards for heading control systems*

ISO/R 694: *Positioning of magnetic compasses in ships.*

ISO 16328: Gyro compasses for high speed craft.

IEC 60945: Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results.

IEC 61162: *Maritime navigation and radiocommunication equipment and systems - Digital interfaces*

3 Definitions

For the purposes of this standard, the following definitions apply.

3.1 heading

Horizontal direction in which a craft actually points or heads at any instant, expressed in angular units from a reference direction, usually from 000° at the reference direction clockwise through 360° .

3.2 preset heading

Horizontal direction in which a craft is steered or intended to be steered, expressed as the angular direction with respect to north (true/magnetic), from 000° , clockwise through 360° .

3.3 manual steering

Method of controlling the steering gear manually, for example using a steering wheel.

3.4 automatic steering

Method of controlling the steering gear automatically to enable a craft to keep a preset heading, processing the heading information which is obtained by a gyro-compass or magnetic compass, etc..

3.5 change-over device

Device for changing over from automatic to manual steering and vice versa.

3.6 automatic steering device

Device which controls automatic steering.

3.7 proportional rudder adjustment

Adjustment of a component of the total rudder command in proportion to an instantaneous value of the difference between the preset heading and actual heading.

3.8 derivative rudder adjustment

Adjustment of a component of the total rudder command which acts to control the rate of turn of the craft.

NOTE The term "derivative rudder adjustment" is also called "counter rudder adjustment" customarily.

3.9 integral rudder adjustment

Adjustment of a component of the total rudder command which is in proportion to the integral value of the heading deviation.

3.10 weather adjustment

Adjustment which minimizes unnecessary steering motion against yawing caused by waves, swells and wind.

3.11 adjustment control

Device which changes the characteristics of an automatic steering device, including proportional rudder adjustment, derivative rudder adjustment, integral rudder adjustment and weather adjustment.

3.12 operational device

Switch, key, knob, etc. which is used for operating a heading control system.

3.13 heading signal processor

Unit which processes the heading signal generated by a gyro-compass, magnetic compass, etc., and adapts it before its use by the heading control system.

3.14 override function

An intentional fast change-over from automatic to temporary manual control.

3.15 conning position

Place on the bridge with a commanding view providing the necessary information and equipment for the conning officer to carry out his functions.

3.16 turn rate control

Method of controlling the rudder of a vessel to perform turns with a preset rate of turn.

3.17 turning radius control

Method of controlling the rate of turn of a vessel to perform turns with a preset turning radius.

4 Performance

4.1 General

4.1.1 *The heading control system* shall *be capable of adapting manually or automatically to different steering characteristics of the* craft *under various speed, weather and loading conditions, and provide reliable operation under prevailing environment and normal operational conditions.*

4.1.2 The heading control system shall *be connected to the gyro-compass if a gyro-compass is provided. Otherwise it* shall *be electronically connected to the magnetic compass.* The gyro-compass shall comply with **ISO 16328**.

4.1.3 *A qualitative description of the effects of the* heading control system *errors due to high speed, accelerations,* heading *changes, sea state, etc., and a qualitative description of corresponding errors in other navigation* system, shall *be provided to the user.*

4.1.4 Heading control systems shall conform to the environmental requirements of **IEC 60945** for equipment category protected from the weather.

4.2 Constituents

A heading control system shall be composed, as a minimum, of the following components (see **figure 1**):

a) Heading signal processor (including an indicator of the heading).

b) Operational control for preset heading.

c) Operational controls for adjustments.

d) Automatic steering devices.

e) Change-over device (with steering mode indicator) which is not required to be an integrated part of the heading control system.

f) Alarm signalling facilities compliant with the requirements of this standard.

g) Indicators for steering mode and heading source in use.

4.3 Functional requirements

The following requirements shall be fulfilled.

4.3.1 Change-over from automatic to manual steering and vice versa

4.3.1.1 *Change-over from automatic to manual steering and vice versa* shall *be possible at any position of the rudder and* shall *be activated by one manual control within 3 seconds.*

4.3.1.2 *Change-over from automatic to manual steering* shall *be possible under any conditions, including any failure in the* heading *control system.*

4.3.1.3 *When changing-over from manual to automatic steering, the* heading control system *(automatic pilot)* shall *take over the actual heading as the preset* heading.

4.3.1.4 Change-over from manual steering with override function to automatic steering shall not be possible without intended action of the craft's personnel.

4.3.1.5 *Change-over* devices shall *be located close to each other in the immediate vicinity of the* position at which the equipment is normally operated.

4.3.1.6 *Adequate indication* shall *be provided to show which method of steering is in operation at a particular moment.* This indicator shall be fitted near the change-over devices.

4.3.1.7 *The installation* shall *include manual steering with an override function.*

4.3.2 Operational controls including adjustment controls

4.3.2.1 *All operational controls* shall *permit normal adjustments to be easily performed and* shall *be easy to identify from the position at which the equipment is normally operated. Controls not required for normal operation* shall *not be readily accessible.*

4.3.2.2 *The* heading control system shall *be provided with automatic and manually operated controls for operational use to adjust the craft's steering performance to take account of the effects of weather.*

4.3.2.3 *Adequate illumination* shall *be provided in the equipment or in the craft to enable identification of controls and facilitate reading of indicators at all times. Means* shall *be provided for dimming the output of any equipment light source which is capable of interfering with navigation.*

4.3.2.4 *The heading control system* shall *be designed in such a way as to ensure altering the preset heading to starboard by turning the heading setting control clockwise or tilting it to the right-hand side.* Turning the control counterclockwise or tilting it to the left shall effect a similar alteration to port. *Normal alterations of heading shall be possible by one adjustment only of the preset heading control.* Requirements shall be made by means of the design and the construction of the preset heading control to preclude unintended alteration of heading.

4.3.2.5 When changing heading, the clockwise or counterclockwise direction of preset heading adjustment shall determine the craft's turning direction.

4.3.2.6 *Where remote control stations are provided, facilities for the delegation of control to the remote station and unconditional return of control* shall *be incorporated in the master station.*

4.3.2.7 *Except for the preset heading setting control, the actuation of any other control* shall *not significantly affect the heading of the craft.*

4.3.2.8 *Additional controls at remote positions* shall *comply with the provisions of these performance standards.*

4.3.3 Rudder angle limitation

Means shall *be incorporated in the equipment to enable* adjustable *rudder angle limitation in the automatic mode of operation. Means* shall *also be available to indicate when the angle of limitation has been commanded or reached. When other means of directional control are used the requirements of this section shall appropriately apply.*

4.3.4 Permitted yaw

Means shall *be incorporated to prevent unnecessary activation of the rudder due to normal yaw motion.*

4.3.5 Heading indication accuracy

If there is a heading indication it shall not deviate from the heading sensor by more than 0,5° .

4.3.6 Preset heading

Any alteration of preset heading shall *not be possible without* intended *action* of *the craft's personnel.*

4.3.7 Performing turns

The heading control system shall *be able to perform turns within the turning capability of the craft based either on a preset rate of turn or a preset turning radius.*

4.3.7.1 Preset rate of turn

If the heading control system is provided with the function to perform turns with a preset rate of turn, the accuracy of the rate of turn after getting constant in a turn, shall be within ± 10 % of its preset value or 3° /minutes, whichever is the greater, with the craft's normal load condition and in a calm sea which is so broad and deep as to be able to manoeuvre free from disturbances against the craft's manoeuvrability.

NOTE It is noted that there are some cases where it is not possible to turn at the preset rate, even if steered at the maximum rudder angle, due to the effects of weather, sea state or craft's manoeuvrability.

4.3.7.2 Preset turning radius

If the heading control system is provided with the function to perform turns with a preset turning radius, the accuracy of the radius after getting constant in a turn, shall be calculated based on the data of **4.3.7.1**.

NOTE It is noted that there are some cases where it is not possible to turn at the preset turning radius, even if steered at the maximum rudder angle, due to the effects of weather, sea state or craft's manoeuvrability.

4.3.8 Limiting of overshoot

The heading control system shall include a counter rudder angle adjustment control or similar system to allow the *change to a preset heading without significant overshoot.*

4.3.9 Power supply

4.3.9.1 A heading control system shall be capable of normal operation under variation of its power supply as specified in **IEC 60945**.

4.3.9.2 *If provision is made for operating equipment from more than one source of electrical energy, arrangements for rapidly changing from one source to the other* shall *be provided but not necessarily incorporated in the equipment.* Means shall be provided to retain the current heading during alteration of the power source.

4.3.10 Alarms and signaling facilities

4.3.10.1 Failure or reduction in power

An *alarm both audible with mute function and visual* shall *be provided in order to indicate failure or a reduction in the power supply to the heading control system or heading monitor, which would affect the safe operation of the equipment.* The alarm signaling facilities are not required to be an integrated part of the heading control system.

4.3.10.2 System failure

An alarm both audible with mute function and visual shall *be provided in order to indicate* any malfunction of the heading control system, *which would affect the safe operation of the equipment.*

NOTE The term "heading control system" used in this subclause is shown schematically in **Figure 1**.

4.3.10.3 Off-heading alarm

An off-heading alarm, both audible with mute function and visual shall *be provided when the actual heading information deviates from the preset heading beyond a preset limit.* The preset limit shall be set within a minimum range of 5° to 15 ° .

NOTE 1 Off-heading is a situation where the craft has deviated from the preset heading.

NOTE 2 The "preset limit" specified in the provisions means just an alarm threshold.

4.3.10.4 Heading monitor

If the craft *is required to carry two independent compasses, a heading monitor* shall *be provided to monitor the actual heading information* from *independent heading sources. The heading monitor is not required to be an integrated part of the heading control system. An alarm both audible with mute function and visual* shall *be provided when the heading information in use deviates from the second heading source beyond a preset limit.* The preset limit shall be set within a minimum range of 5° to 15° .

NOTE The "preset limit" specified in the provisions means just an alarm threshold.

4.3.10.5 Indication of heading source

A clear indication of the heading source in use shall *be provided.*

4.3.10.6 Sensor status

The heading control system shall *provide an indication when any input from external sensors used for control is absent. The heading control system* shall *also repeat any alarm on the status messages concerning the quality of the input data from its external sensors when they are used for control.*

4.3.10.7

The alarm signalling facilities shall *be fitted near the conning position* and easily accessible.

4.3.11 Transformation error

The heading data supplied to the heading control system shall not deviate by more than 0,5° from the heading sensor.

4.3.12 Heading stability

The heading stability shall be such that, under conditions of no disturbance, the average value of the difference between the preset heading and the heading within ±2° and the maximum single amplitude is within 3° . Under the conditions of disturbances give in **Annex A**, the above mentioned average value shall be within ±3° and the maximum single amplitude shall be within 4° .

4.3.13 Disturbance to the magnetic compass

The disturbance to the magnetic compass caused by the magnetic sensor, if driven and used, shall not be more than 0,5° . This shall be fulfilled on any heading with the power supply of the heading control system switched on or off.

4.3.14 Interfaces

4.3.14.1 The heading control system shall be connected to a suitable source of heading information.

4.3.14.2 The heading control system shall be connected to a suitable source of speed information when it is used in a turning radius mode or when any control parameters are automatically adapted to speed.

4.3.14.3 *The* heading control system shall *provide interface facilities conforming to relevant international interface standards.* Digital serial interfaces shall comply with **IEC 61162.**

4.4 Safety precautions

All safety precautions in the heading control system shall be compliant with **IEC 60945.**

5 Type testing

5.1 Testing and required results

The following tests shall be carried out in the order as given below: For tests carried out by means of the craft motion simulator refer to the specification given in **Annex B.**

5.2 Structure and magnetic safe distance test

The determination of compass safe distance shall be carried out in accordance with the requirements of **ISO/R 694.** All parts of the system and their interconnections shall be considered.

5.3 Environmental tests

5.3.1 Vibration

The vibration test shall be carried out in accordance with the requirements of **IEC 60945.**

5.3.2 Dry heat

The dry heat test shall be carried out in accordance with the requirements of **IEC 60945.**

5.3.3 Damp heat

The damp heat test shall be carried out in accordance with the requirements of **IEC 60945.**

5.3.4 Low temperature

The low temperature test shall be carried out in accordance with the requirements of **IEC 60945.**

5.4 Power supply

5.4.1 Power supply variation

The power supply variation test shall be carried out in accordance with the requirements of **IEC 60945.**

5.4.2 Power supply failure

The power supply failure test shall be carried out by turning off the power supply to the heading control system while the power supply of the alarm unit remains on. The requirements of **4.3.10.1** shall be complied with.

5.5 Electromagnetic compatibility

5.5.1 Conducted emission

The conducted interference test shall be carried out in accordance with the requirements of **IEC 60945**.

5.5.2 Radiated emission

The radiated interference test shall be carried out in accordance with the requirements of **IEC 60945**.

5.6 Immunity to electromagnetic environment

Immunity tests shall be carried out in accordance with the requirements of **IEC 60945**.

5.7 Acoustic noise

The acoustic noise test shall be carried out in accordance with the requirements of **IEC 60945**.

5.8 Change-over from automatic to manual steering mode

The automatic to manual steering mode change-over test shall be carried out as follows;

a) During the mode of automatic steering, turn the steering wheel so that it produces a 0° rudder angle command.

b) Set the rudder angle limiter to maximum, then set the preset heading to obtain the maximum rudder angle.

c) Change from automatic steering to manual.

d) Measure the time required from the completion of the mode change-over operation to when the rudder midship command signal is given. This time shall comply with the requirements of **4.3.1.1**.

5.9 Control characteristic

The following tests shall be carried out using a craft motion simulator. The simulator described in **Annex B** shall be the standard simulator to be used for these tests.

5.9.1 Heading signal transformation accuracy

Set the simulator's craft heading to 8 different values and compare them with the heading indicated by the heading control system. This measurement shall be carried out twice for both the clockwise direction and the counterclockwise direction respectively. The requirements of **4.3.11** shall be complied with.

5.9.2 200° turn

5.9.2.1 This test shall be made by means of the craft motion simulator as specified in **Annex B** with $l / v = 2$. Automatic heading change, without the function of the preset rate of turn or the preset turning radius.

The preset heading control shall be turned right or left to make 200° heading change according to **4.3.2.5** and the following shall be checked.

a) When turning the preset heading control clockwise, a right heading change is made and when turning the preset heading control counter clockwise, a left heading change is made. (In each case the heading change is made with respect to the preset direction.)

b) After actuating a heading change, the rudder angle limiting function is activated.

5.9.2.2 This test shall be made by means of the craft motion simulator as specified in **Annex B** with $l / v = 2$, and the rudder angle limiter shall be set to maximum. The preset heading control shall be turned right or left to make 200° heading change. The requirements of **5.9.2.1a)** shall be complied with and the rate of turn or the turning radius

respectively shall be within the defined accuracies in **4.3.7.1** and **4.3.7.2**. Provided that the preset turning radius is tested, it is ensured that the craft's heading turns with the rate given by the following formula :

$$\dot{\psi}i = (180 / \pi) \times (v / r)$$

where

$\dot{\psi}i$ is the prest rate of turn, in degrees per second ;

r is the preset turning radius, in metres ;

v is the craft's speed, in metres per second.

This test shall be carried out 6 times for both directions and with the maximum value, the mean value and the minimum value respectively.

NOTE 1 Horizontal acceleration $a = V.^2_1$ does not exceed 2,0 m/s^2.

NOTE 2 In this test, the rate of turn or the turning radius should be selected so that horizontal acceleration does not exceed 2,0 m/s^2.

5.9.3 Heading stability

This test shall be made by means of the craft motion simulator as specified in **Annex B** with $l / v = 2$. It shall be tested under the conditions of no disturbance and disturbance as specified in **Annex A** for more than 10 minutes respectively. The requirement of **4.3.12** shall be complied with.

5.9.4 Overshoot

This test shall be made by means of the craft motion simulator as specified in **Annex B** with $l / v = 2$. Change the preset heading from the actual heading by 20° right and left. The overshoot shall not be more than 2° .

6 Fall-back arrangements

In case of failure of the heading sensor in use or the heading control system itself the actual rudder angle shall be maintained. An associated alarm as specified under **4.3.10** shall be given.

7 Marking and identification

Each unit of a heading control system shall be marked with the following:

- *identification of the manufacturer;*

- *equipment type number or model identification under which it was type tested;*

- *serial number of the unit.*

- magnetic compass safe distance (for an unit installed in the bridge).

8 Information

Adequate information shall *be provided to enable the equipment to be properly operated and maintained.*

The information shall

a) *in the case of equipment so designed that fault diagnosis and repair down to component level are practicable, provide full circuit diagrams, component layouts and a component parts list, and*

b) *in the case of equipment containing complex modules in which fault diagnosis and repair down to component level are not practicable, contain sufficient information to enable a defective complex module to be located, identified and replaced. Other modules and those discrete components which do not form part of modules* shall *also meet the requirements of* a) *above.*

c) If the heading control system is provided with functions for rate of turn or turning radius control it shall be notified that the preset values may not be reached under certain conditions of weather, sea, speed, load, draft, trim, etc. Further it shall be pointed to the fact that incorrect speed input will lead to incorrect radius control.

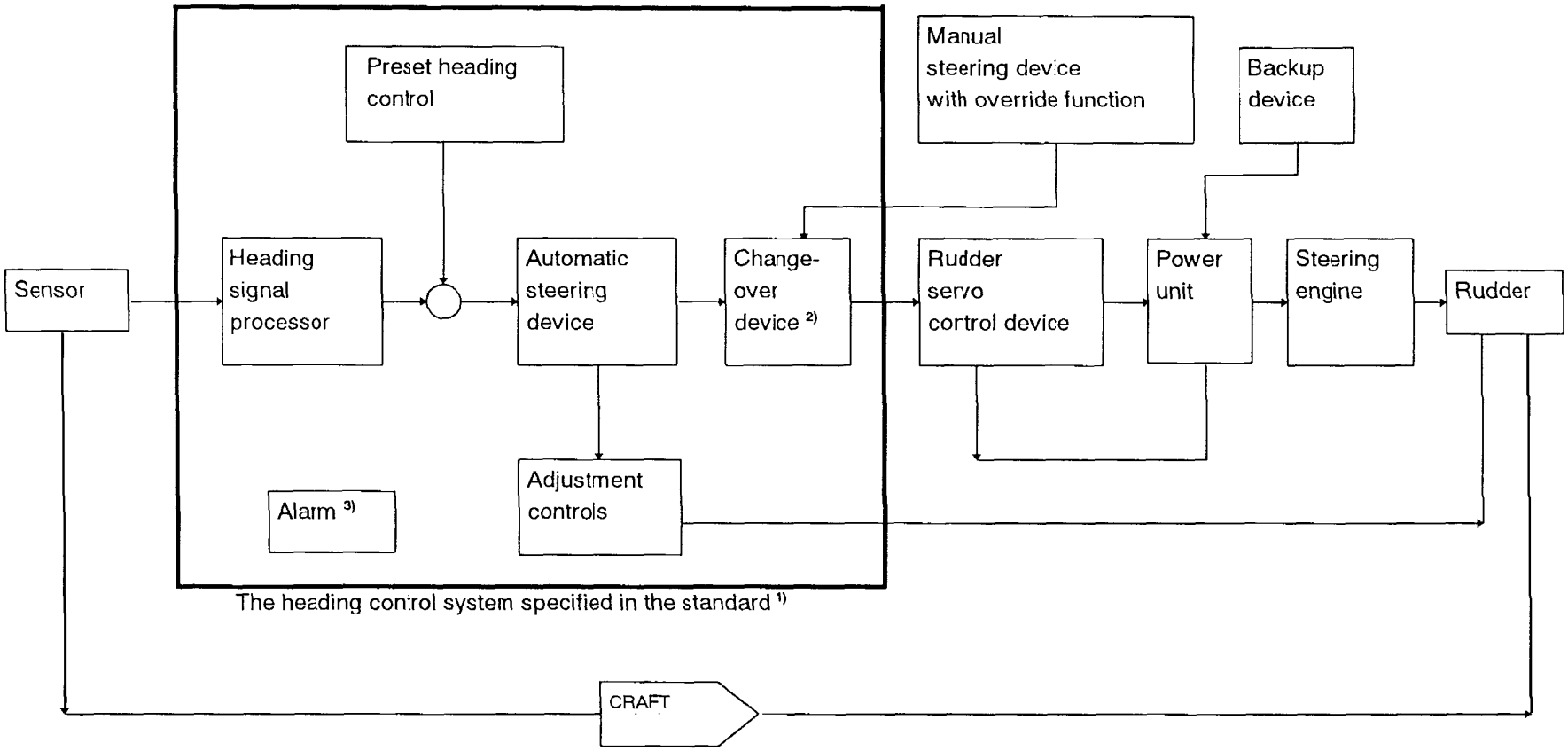


Figure 1 – Control devices for heading control systems

1) Portion enclosed by the thick line shows the constituent devices of a heading control system which are specified in this standard.

2) The change-over device is not required to be an integrated part of the heading control systems.

3) Alarm indicating devices may be external units.

Annex A
(normative)

Heading stability test under the conditions of disturbance

Annex A specifies the disturbance which is used in the "heading stability test". The disturbance to be used should be of rectangular waves equivalent to rudder angles. The wave forms are defined in **Table A.1**.

Table A.1

Time (s)	0 ~ 60	60 ~ 120	120 ~ 180	180 ~ 240	240 ~ 360	360 ~ 380	380 ~ 410	410 ~ 440	440 ~ 460	460 ~ 600
Amplitude (°)	0.0	+2.0	0.0	-2.0	0.0	+3.0	0.0	-3.0	0.0	+3.0

For information, course-keeping simulation results obtained when the specified disturbances act are shown. When simulating, the K-T model shown in **Annex B** as a ship hull response model, and for the heading control system, a model which has the transfer function shown below were used.

$$\frac{\delta(s)}{e(s)} = K_p + T_d s + \frac{1}{T_i s}$$

where,

$\delta(s)$: rudder angle ;

e(s) : bearing error ;

K_p, T_d, and T_i : parameters of the heading control system ;

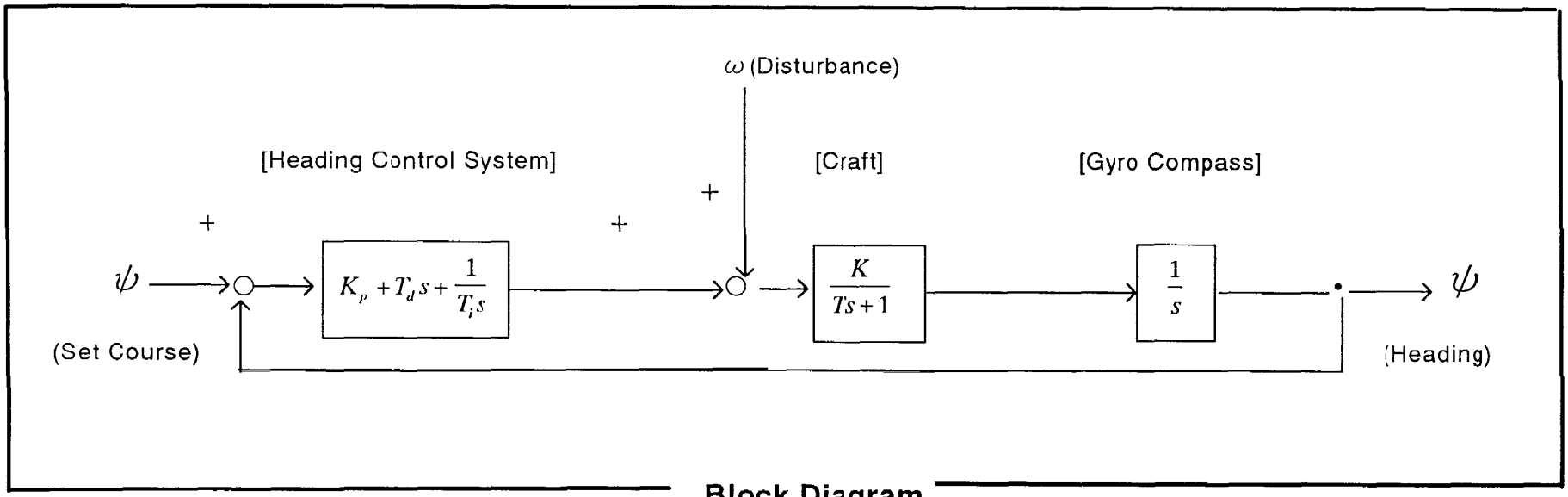
s : Laplacian operator.

A simulation block diagram and the transfer function which shows the transfer of the disturbance to the ship's bearing are shown in **Figure A.1**. The parameters of the ship hull response and the heading control system used for the simulation are shown in **Table A.2**.

Table A.2

Parameter	L/V	K'	T'	K_p	T_d	T_i
Value	2,0	1,0	1,0	1,0	1,5	11,7

The results are shown in **Figure A.2**.



Block Diagram

Transfer Function

$$\frac{\psi(s)}{\omega(s)} = \frac{s}{(T/K)s^3 + (1/K + T_d)s^2 + K_p s + 1/T_i}$$

Figure. A.1

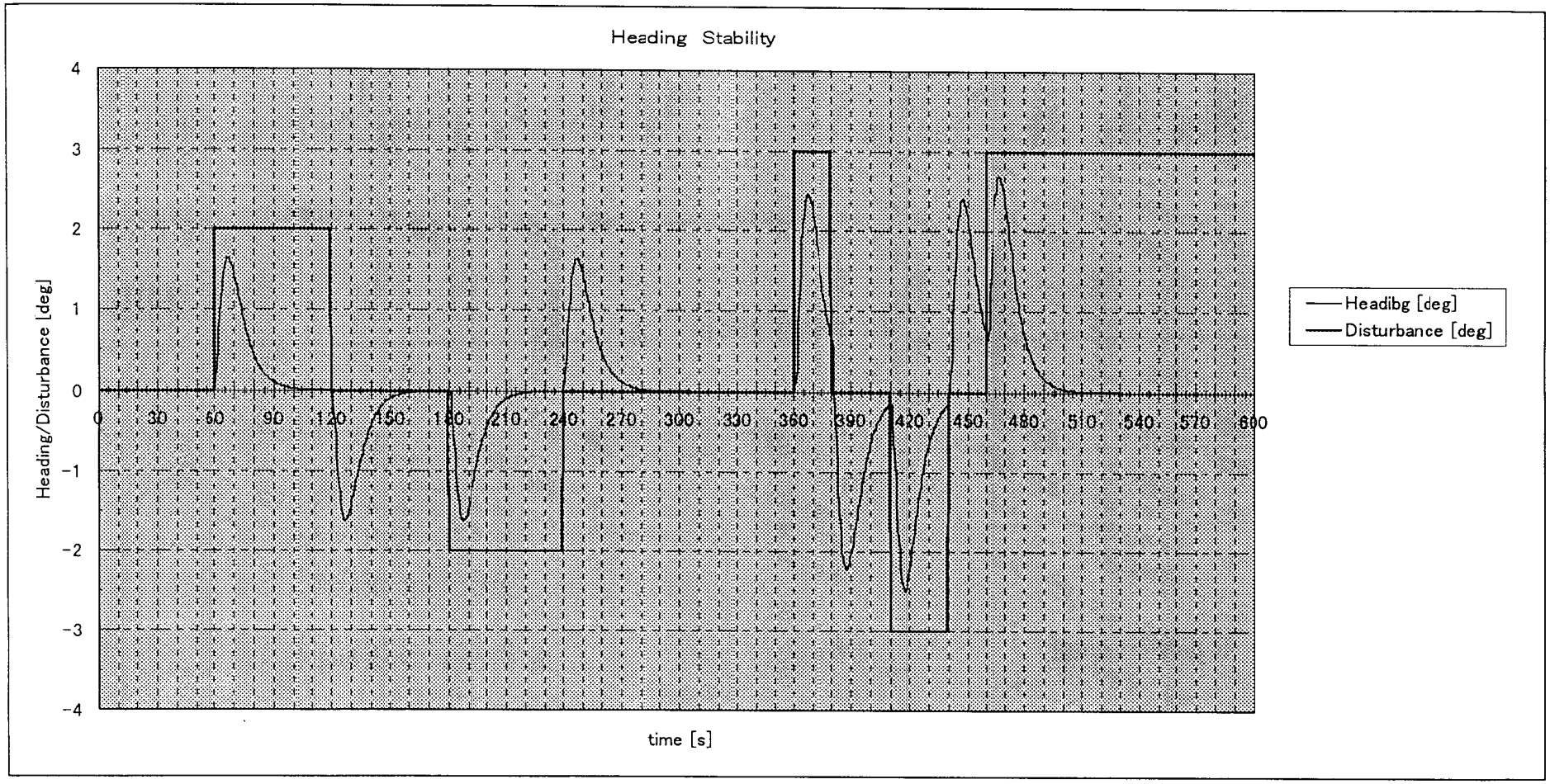


Figure.A.2 Simulation Result

Annex B
(normative)

Craft motion simulator

The following shall be the standard for a craft motion simulator. The craft maneuverability model shall be the $K - T$ (transfer function) model, represented by:

$$\frac{\dot{\psi}}{\delta} = \frac{K}{TS + 1}$$

where

$\dot{\psi}$ is the rate of turn of the craft, in degrees per second;

δ is the rudder angle, in degrees;

K is the turning ability constant of the craft, in reciprocal seconds;

T is the time constant of the craft, in seconds;

S is the Laplace operator, in reciprocal seconds.

K and T shall be converted from K' and T' as follows:

$$K = K'/(l/v) \qquad T = T'(l/v)$$

where

K' is the turning ability of the non-dimensional maneuverability index ; $K' = 1$;

T' is the course retaining ability of the non-dimensional maneuverability index ; $T' = 1$;

l is the length of the craft provided with a heading control system, in metres;

v is the speed of the craft provided with a heading control system, in metres per second.

The steering engine model (transfer function) shall be based on the following expression:

$$\frac{\delta}{\delta^*} = \frac{1}{T_E S + 1}$$

where

δ is the rudder angle, in degrees;

δ^* is the actuated rudder angle, in degrees;

T_E is the time constant of the steering engine, in seconds;

S is the Laplace operator, in reciprocal seconds.

In this case, the rate of the rudder motion ($\mathrm{d}\delta/\mathrm{d}t$) shall be equal to, or less than,15 degrees per second, and T_E shall be equal to 1 seconds.

The bearing resolution and steering engine model sensitivity shall be as follows:

bearing resolution: 0,1° or less

steering engine model sensitivity: 0,2° or less

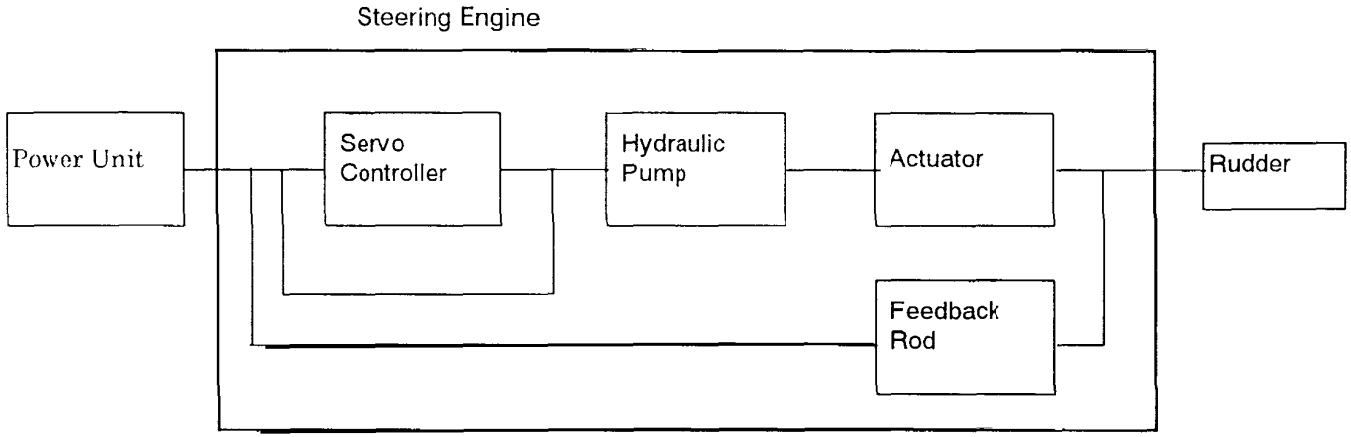


Figure E.2 Block Diagram of Steering Engine

Example of L/V

Ship's Type	Lpp	V(k't)	V(m/s)	L/V
Container	230	22.0	11.31	20.3
Container	273	23.0	11.82	23.1
Bulk Carrier	259	14.0	7.20	36.0
LPG Carrier	212	16.0	8.22	25.8
VLCC	308	15.4	7.92	38.9

Annex C
(informative)

Equivalent requirements in ISO CD 16329 and IMO Resolutions

Clause or sub-clause in ISO CD 16329	Clause or sub-clause in IMO Res.A.822(19) [Performance standards for automatic steering aids for high-speed craft] or IMO Res.A.694(17) or IMO Res. MSC 64(67) annex 3 : 1997, Amendment to resolution A.342(IX)	Clause or sub-clause in ISO DIS 11674 [Ships and marine technology– Heading control systems]
1	A.822(19) 1.1 and 1.2	1*
2		2*
3.1		3.2
3.2		3.1
3.3		3.3
3.4		3.4
3.5		3.5
3.6		3.6
3.7		3.9
3.8		3.10*
3.9		3.11
3.10		3.12
3.11		3.7
3.12		3.8
3.13		3.13
3.16		3.14
3.17		3.15
4.1.1	A.822(19) 2.2* and MSC 64(67) annex 3:1997 3.1	4.1.1

4.1.2	A.822(19) 2.3	
4.1.3	A.822(19) 2.4	
4.1.4		4.1.2
4.2		4.2
4.3.1.1	A.822(19) 3.1* and MSC 64(67) annex 3:1997 4.1	4.3.1.1
4.3.1.2	A.822(19) 3.2 and MSC 64(67) annex 3:1997 4.2	4.3.1.2
4.3.1.3	A.822(19) 3.3 and MSC 64(67) annex 3:1997 4.3*	4.3.1.3*
4.3.1.5	A.822(19) 3.4	4.3.1.4*
4.3.1.6	A.822(19) 3.5 and MSC 64(67) annex 3:1997 4.5	4.3.1.5
4.3.1.7	A.822(19) 3.6	
4.3.2.1	A.694(17) 3.2	4.3.2.1
4.3.2.2	A.822(19) 5.1	
4.3.2.3	A.694(17) 3.3	4.3.2.3
4.3.2.4	A.822(19) 5.2* and MSC 64(67) annex 3:1997 7.3	4.3.2.5
4.3.2.5		4.3.2.6
4.3.2.6	MSC 64(67) annex 3:1997 7.4	4.3.2.7
4.3.2.7	A.822(19) 5.3* and MSC 64(67) annex 3:1997 7.5	4.3.2.8
4.3.2.8	A.822(19) 5.4 and MSC 64(67) annex 3:1997 7.6*	4.3.2.9
4.3.3	A.822(19) 6 and MSC 64(67) annex 3:1997 3.3*	4.3.3
4.3.4	A.822(19) 7 and MSC 64(67) annex 3:1997 3.4	4.3.4
4.3.5		4.3.5
4.3.6	A.822(19) 3.3 and MSC 64(67)	4.3.6

	annex 3:1997 3.5	
4.3.7	A.822(19) 5.5	
4.3.7.1		4.3.7
4.3.7.2		4.3.8
4.3.8		4.3.9
4.3.9		4.3.10
4.3.9.1		4.3.10.1
4.3.9.2	A.694(17) 4.3	4.3.10.2
4.3.10.1	A.822(19) 4.1 and MSC 64(67) annex 3:1997 6.1	4.3.11.1
4.3.10.3	A.822(19) 4.2* and MSC 64(67) annex 3:1997 6.2	4.3.11.2*
4.3.10.4	A.822(19) 4.3* and MSC 64(67) annex 3:1997 6.3	4.3.11.3*
4.3.10.5	MSC 64(67) annex 3:1997 6.4	4.3.11.4
4.3.10.6	A.822(19) 4.4* and MSC 64(67) annex 3:1997 6.5	4.3.11.5
4.3.10.7	A.822(19) 4.5	4.3.11.6
4.3.11		4.3.12
4.3.12	A.822(19) 2.1*	4.3.13*
4.3.13		4.3.14
4.3.14.1		4.3.15.1
4.3.14.2		4.3.15.2
4.3.14.3	A.822(19) 8	4.3.15.3*
4.4		4.4
5.1		5.1
5.2		5.2
5.3.1		5.3.1
5.3.2		5.3.2
5.3.3		5.3.3
5.3.4		5.3.4

5.4.1		5.4.1
5.4.2		5.4.2
5.5.1		5.5.1
5.5.2		5.5.2
5.6		5.6
5.7		5.7
5.8		5.8
5.9		5.9
5.9.1		5.9.1
5.9.2.1		5.9.2.1
5.9.2.2		5.9.2.2
5.9.3		5.9.3*
5.9.4		5.9.4*
7	A.694(17) 9	6
8.a)	A.694(17) 8.3.1	7.a)
8.b)	A.694(17) 8.3.2	7 b)
8.c)		7 c)

* slight differences in text

Annex D
(informative)

Bibliography

[1] IMO Resolution A.210(Ⅶ), Recommendation on steering gear for large ships.

[2] SOLAS 1974, Chapter Ⅱ-1, Regulations 29 and 30.

[3] SOLAS 1981, Chapter Ⅴ, Regulation 19.

[4] ISO 2412:1982, Shipbuilding - Colours of indicator lights.

[5] ISO 8468:1990, Ship's bridge layout and associated equipment - Requirements and guidelines.

[6] IEC 92-204:1987, Electrical installations in ships - Part 204: System design - Electric and electrohydraulic steering gear.

Comments on ISO/CD 16329 "Ships and marine technology - Heading control systems for high-speed craft"

Country	Item	Proposal	Reason/Comments	Observation of the secretariat on each comment submitted
Germany	1. Scope 3	Delete "..~~between 70° and 70° S~~..."	Applicable for HSC gyro compass only, editorial	Not accepted Reason: The text of the CD draft is an extract from the IMO resolution. Therefore, the comment can not be accepted.
Germany	1. Scope 3rd par	Add: "...*resolution A.342(IX)* as amended by MSC.64(67) Annex 3..."		Partly accepted. The purport of the comment is to be carried not in the body of the text but "NOTE", in conformity with the expression of ISO/DIS 11574.
Germany	2	Add: "ISO 16328 - Gyro compasses for high speed craft"	See Page 3, 4.1.2	Accepted.
Germany	3. Definition	· Swap 3.1 and 3.2 Delete "... true..." twice in 3.1 · Move 3.9, 3.10, 3.11, 3.12 to before 3.7	· Define heading first because it is a more global term System may be operated by magnetic compass. · 3.7 uses terms of 3.9, 3.10, 3.11, 3.12 before they are defined	· Accepted. · Accepted.

Japan	3.1 preset heading	Replace by " ～ with respect to north (true/magnetic), from 000° , clockwise through 360° . "		Accepted.
Japan	3.10 derivative rudder adjustment	Add: NOTE The term "derivative rudder adjustment" is also called "counter rudder adjustment" customarily.	The term "derivative rudder" is not the one commonly accepted. In lieu of it, many makers use the term "counter rudder".	Accepted.
Germany	3.15	· Replace "Place" by "Location" · Insert after 3.15 a definition for main-steering position (used in 4.3.1.5) and a definition for steering position (used in 4.3.1.6)	· Better understanding · Words are used in text.	· Not accepted. Reason: Editorial matter. · Not accepted. Reason: In subclause 4.3.1.5, "main-steering" has been deleted and in subclause 4.3.1.6 "steering position" has been deleted.
Germany	4.1.2	Add after last sentence: "The gyro compass shall comply with ISO 16328 Gyro-compasses for high-speed craft."	· For clarification	Accepted.
Germany	4.2	· Substitute "~~Constituents~~" by "Composition" · Substitute "...following ~~devices~~" with "... following components"	· More common term · Functions or components may be located in one or more devices. Components is more general.	· Not accepted. Reason: Editorial matter. · Accepted.
China	4.3.1.1	We suggest that add "charge-over time shall be not longer than 3 seconds" at the end of items.	To ensure safety.	Accepted.

Germany	4.3.1.1	Delete "...~~by means of bumpless transfer~~." Add "...rudder position and shall be activated by one manual device and action within 3 seconds."	Text similar to ISO 11674	Accepted.
U.S.A. + U.S.A. (IEC/TC 80)	4.3.1.1	4.3.1.1 It appears that the goal is to change from automatic to manual and v.v. and retain the manually set helm bias (weather helm) in order to maintain course control without transient. However, changing from manual to automatic during a turn cannot be bumpless since the auto preset heading order must initialize on the current heading in accordance with 4.3.1.3 – which results in application of rudder for immediate pull out of the turn to the preset heading. It appears that this requirement can only apply during maintenance of a steady state course.		Not accepted. Reason: The Chinese and German proposals regarding the above subclause 4.3.1.1 have been accepted, which must surely have improved the contents of the provision.
China	4.3.1.2	We suggest that add"change-over time shall be not longer than 3 seconds"at the end of items.	To ensure safety.	Not accepted. Reason: The requirement for the change-over time 'not longer than 3 seconds" has been included in subclause 4.3.1.1 (to avoid having a duplicate provision).
Japan	4.3.1.5	Amend the sentence as follows; *4.3.1.5 Change-over* devices shall *be located close to each other in the immediate vicinity of the ~~main steering or conning position~~* at which the equipment is normally operated.	Better understanding.	Accepted.

Germany	4.3.1.6	Replace "...near the change-over ~~control~~" by "..near the change-over devices"	to be compliant with definition.	Accepted.
Germany	4.3.2.4	Delete paragraph completely	Covered by 4.3.2.2 completely	Accepted.
Germany	4.3.2.5	· Add "...the controls of..." · Add "...turning the heading control clockwise or tilting it to the right-hand side."	· Editorial · The control may be a vertical tiller instead of a knob	· Accepted. · Accepted. In addition, the expressions of others of this subclause are brought into line with subclause 4.3.2.5 of ISO/DIS 11674.
Germany	4.3.2.6	· Replace "...changing ~~course~~..." by "... changing heading" · Replace "...direction of ~~course~~..." by "...direction of preset heading" · Delete second sentence: "The turning... preset heading."	Terminology Does not fit to operation of a vertical tiller.(see 4.3.2.5)	· Accepted. · Accepted. · Accepted. In addition, the expressions of others of this subclause are brought into line with subclause 4.3.2.6 of ISO/DIS 11674.
Germany	4.3.2.7	Delete "...provided, ~~facilities for the delegation of control to the remote station and~~ unconcitional..."	For clarification	Not accepted. Reason: This subclause has been brought into line with ISO 11674, which means it is in line with the IMO resolution. Therefore, the comment is not accepted.

Germany	4.3.5	Replace "...from the ~~compass heading~~" by "...from the heading sensor"	Consistent terminology	Accepted.
Germany	4.3.7.1	Add: "...±10 % of its preset value or 3°/minute, whatever is greater, with ..."	To match with ISO 11674	Accepted. In addition, the expressions of others of this subclause are brought into line with subclause 4.3.7 of ISO/DIS 11674.
Germany	4.3.7.1 NOTE	Add: "...of weather or sea state or ship manoeuvrability"	Various loading or trim conditions may lead different ship steering parameters.	Accepted.
Germany	4.3.7.2	"Replace"...be ~~within ±10%...the crafts manoeuvrability~~" by "...be calculated based on the data of 4.3.7.1"	to be in consumption with ISO 11674	Accepted. In addition, the expressions of others of this subclause are brought into line with subclause 4.3.8 of ISO/DIS 11674.
Germany	4.3.7.2. NOTE	*Add: "...of weather or sea state or ship manoeuvrability"	Various loading or trim conditions may lead different ship steering parameters.	Accepted.
Japan	4.3.9 Power supply	・Replace text as follows; "4.3.9 Power supply (Title only) 4.3.9.1 A heading control system shall be capable of normal operation under variation of its power supply as specified in IEC 60945." ・Delete subclause 4.3.9.1 completely.	Subclause 4.3.9 overlaps with Subclause 4.3.9.1 Covered completely by 4.3.9	・Accepted. ・Accepted.

Germany	4.3.9.1	Delete completely	Covered completely by 4.3.9	Accepted.
Germany	4.3.10.xx	Insert a new clause "4.3.xx System failure An alarm both audible and visual shall be provided in order to indicate any malfunction of the heading control system."	There may be other failures but power failure making the system inoperative.	Accepted. The proposed text is accepted as a new subclause 4.3.10.2 as follows. "4.3.10.2 System failure An alarm both audible with mute function and visual shall be provided in order to indicate any malfunction of the heading control system, which would affect the safe operation of the equipment. NOTE: The term "heading control system" used in this subclause is shown schematically in Figure 1."
China	4.3.10.2, line 3	We suggest rewrite the sentence as follows: The preset limit shall be set at 3°.	Identical with subclause 4.3.12.	Not accepted. Reason: The following German opinions have been accepted and "3° " is the value for heading stability when there is no disturbance.

Germany	4.3.10.2 2nd par.	Replace "The ~~present limit~~ shall..." by "The alarm threshold shall..."	Value is no limit but a threshold.	Partly accepted. The purport of the comment is to be carried not in the body of the text but "NOTE".
Germany	4.3.10.2	Add behind 3rd line : "The audible alarm should be provided with a mute function and a visual display."		Accepted. In addition, the expressions of others of this subclause are brought into line with subclause 4.3.11.2 of ISO/DIS 11674.
Germany	4.3.10.3	Replace completely by text used in ISO 11674, 4.3.18.3 Heading monitor	To match with ISO 11674	Accepted. In addition, the expressions of others of this subclause are brought into line with subclause 4.3.11.3 of ISO/DIS 11674.
Germany	4.3.10.5	Insert "...from an external sensor used for control is absent ..."	To match with ISO 11674	Accepted. In addition, the expressions of others of this subclause are brought into line with subclause 4.3.11.5 of ISO/DIS 11674.
Japan	4.3.10.5 Sensor status	Amend the sentence as follows: "~*when any input from ~~an~~ external sensor*~"	Editorial.	Accepted.

Germany	4.3.10.6	Delete "...accessible ~~and close to the automatic steering device~~."	Hardware of the automatic steering device may be located anywhere on the ship.	Accepted. In addition, the expressions of others of this subclause are brought into line with subclause 4.3.11.6 of ISO/DIS 11674.
Japan	4.3.10.6	Amend the sentence as follows: "~*fitted near the* ~~*steering or*~~ *conning position* ~"	See our comment of Subclause 4.3.1.5.	Accepted.
Germany	4.3.11	Replace "~~1,0~~°" by "0,5°"	see 4.3.5 an ISO 11674	Accepted.
China	4.3.12	We suggest that conditions of disturbance shall be specified including calculations for sea condition and disturbance.	The value "±2° " and the test for " Heading stability " is meaningless under conditions of no disturbance.	Partly accepted. As a result of deliberation on the Chinese and German proposals in regard to this subclause, new Annex A (normative) has been provided as an addition, so as to provide details on this subclause.
Germany	4.3.12	4th line alter to read :" ... within ±[3]°."		Partly accepted. As a result of deliberation on the Chinese and German proposals in regard to this subclause, new Annex A (normative) has been provided as an addition, so as to provide details on this subclause.

Germany	4.3.12	Add a new para : "Under the conditions of rough sea, with disturbances of up to ±[4]° the above mentioned average value shall be within ±[3]° and the maximum single amplitude shall be within ±[4]°."	The heading control system shall work sufficiently also under the condition of rough sea.	Partly accepted. As a result of deliberation on the Chinese and German proposals in regard to this subclause, new Annex A (normative) has been provided as an addition, so as to provide details on this subclause.
Germany	4.3.13	· Replace in heading "Disturbance to the .." · Replace in text "The ~~deviation of~~ disturbance to the magnetic..."	· Editorial · Editorial see ISO 11674	· Accepted. · Accepted. In addition, the expressions of others of this subclause are brought into line with subclause 4.3.14 of ISO/DIS 11674.
Germany	4.3.14.3	Replace text by "*The* heading control system shall *provide interface facilities conforming to relevant international interface standards.* Digital serial interfaces shall comply with IEC 61162."	IMO conformity	Accepted.
Germany	5.4.1	Delete last sentence.	4.3.9.1 Table has been deleted.	Accepted.
Germany	e.g. behind 5.7	Add the following item : "Change-over from automatic to manual steering mode the automatic to manual steering change-over test shall be carried out as follows : a) During the mode of automatic steering, turn the steering wheel so that the position of the wheel is at 0°to the rudder angle command. b) Set the preset heading to obtain the maximum rudder angle. c) Change from automatic steering to manual.	The heading control system has to comply with IMO resolution A.342(IX) (see item 1, Scope)	Accepted. The proposed text is accepted as a new subclause 5.8. The expressions are brought into line with subclause 5.8 of ISO/DIS 11674.

		d) Measure the time required from the completion of the mode-change-over operation to when the rudder midship command signal is given. This time shall comply with the requirements of item 2.1 of IMO Resolution A.342(IX)"		
Germany	5.8.1 NOTE	· Correction first line "~~difference~~" to "<u>different</u>" · Delete NOTE completely	· Editorial · Test should be performed anyway	· Accepted. · Accepted.
Germany	5.8.2	Correct heading to "200° turn" 1) l/v should not be constant two values l = 50m l = 150m 2) v should set to v = 30kt v = 50kt v = 70kt 3) Preset Value l and v should be selected so that horizontal acceleration $a = V_{.1}$ does not exceed 0.2 g-Force	Compliance with IEC 11674 v should be variable to enable tests for constant ship's length with different speeds. 0,2 g is required as maximum horizontal acceleration for HSC	Partly Accepted. In view of the fact that l/v = 2, if l or v is determined, the other is necessarily determined. Therefore, 1) and 2) proposed by German are not accepted. 3) is added as new subclause 5.9.2.2 NOTE 1.
Germany	5.8.2.1	Correct in second clause "~~180°~~" to "<u>200°</u>"	Compliance with IEC 11674	Accepted.
Germany	5.8.2.2 1st par.	Replace "... ~~±10 %~~" by "<u>the defined accuracies</u>"	(refer to 4.3.7.1 and 4.3.7.2)	Partly Accepted. Compliance with subclause 5.9.2.2 of ISO/DIS 11674

Germany	5.8.2.2	· Insert in first sentence "... ANNEX A with l/v = 2 and .." · Correct in second sentence "~~180°~~" to "200° " · Correct in formular and definition "ψ" to "ψ(dot)"	· Compliance with 5.8.2.1 · Compliance with 5.8.2.1 · Compliance with IEC 11674	Accepted. Accepted. Accepted.
Germany	5.8.2.2	7th and 9th line, Annex A, 1st formula, definition ψ: Replace ψ by $\dot{\psi}$.	To comply with the denotation in ISO/TR 11674. The letter ψ normally denotes an angle, here the heading angle. The velocity of the change of this angle (here = turn rate) is normally denoted by a point over the letter.	Accepted.
Japan	5.8.2.2	Add: "NOTE In this test, the rate of turn or the turning radius should be selected so that horizontal acceleration does not exceed 2,0 m/s^2.".		Accepted. This proposal is added as new subclause 5.9.2.2 NOTE 2.
China	5.8.3	We suggest that conditions of disturbance shall be specified including calculations for sea condition and disturbance.	The value"±2°"and the test for "Heading stability" is meaningless under conditions of no disturbance.	Not accepted. Reason : The following German proposal has been accepted.
Germany	5.8.3	Use same ship length (l = 50, 150 m) and ship speed (v = 30, 50, 70 kt) as defined in 5.8.2.	Use of practical parameter required	Not accepted. Reason : See above reason on the German comment to subclause 5.8.2.
Germany	5.8.3	4th line : "10 minutes after ..."(delete full stop)		Accepted.

Germany	5.8.3	Add a new para : "Subsequently a random motion of the ship's heading with peak values up to ±[4]°(rough sea) is simulated. It must be possible, by using the means according to 4.3.4, to considerably reduce the rudder activities in rough sea. The average heading over a period of [10] minutes shall in no case deviate from the heading according to 4.3.12 by more than [1]° and the maximum single amplitude shall be within ±[4]°."	See above.	Partly Accepted. On the basis of a German proposal, the provisions of subclause 5.8.3 are amended as follows. " Heading stability This test shall be made by means of the craft motion simulator as specified in ANNEX B with l/v = 2. It shall be tested under the conditions of no disturbance and disturbance as specified in ANNEX A for more than 10 minutes respectively. The requirement of 4.3.12 shall be complied with."
Germany	5.8.4	· Insert as first sentence "This test shall be made by means of the craft motion simulator as specified in ANNEX A set to ..."(see remark below) · Performance test should be made with l = 50, and l = 150 m and v = 30 kt, v = 50 kt, v = 70 kt. · Delete "~~This shall be fullfilled in all modes of automatic.. steering~~" completely	Use of practical and defined parameters required. Test could be done simultaneously with 5.8.2	· Accepted. · Not accepted. Reason : See above reason on the German comment to subclause 5.8.2. · Accepted.

Germany	6	Write" – magnetic compass safe distance ..."	Compliance with IEC 11674	Accepted.
Germany		Add a new clause "X.X Fall-back arrangements In case of failure of the heading sensor in use or the heading control system itself the actual rudder angle shall be maintained. An associated alarm as specified under 4.3.10 shall be given."	For compliance with track control standard. Fall-back operation shall be specified in this standard to minimize any danger in case of a failure and to define the heading control system's reaction in such a way that other devices can react accordingly.	Accepted. A new clause is added as clause 6.
China	Annex A	We think the minimum rate of the rudder motion (d δ /dt) shall be described other than maximum rate of the rudder motion. We suggest that the minimum rate of the rudder motion (d δ /dt) shall be chosen within a range of 5° ~9° (the value is to be discussed).		Not accepted. Reason : The commented matter belongs to the problem of a simulator to be normally used for the equations in the ANNEX.
Germany + Germany (IEC/TC 80)	Other comments	After considering again the above mentioned draft and IMO resolution A.822(19) on which the draft shall be based we came to the following conclusion: IMO resolution A.822(19) was written and accepted at a time when it was already clear that IMO A.342(IX) has to be amended to make it fit to the technology of today. After this had been done and was accepted by MSC 67 the amended resolution IMO A.342(IX) became more up to date than A.822(19) now.		Not accepted. Reason : Endeavour has been made so that the contents are in line with the latest IMO Resolution. This time, the proposal is not accepted. However, if you feel dissatisfied, you are requested to point out the details at the second stage of CD.

		An ISO/IEC standard for HSC heading control systems should therefore be based on the amended resolution IMO A.342(IX) and on the drafted ISO/IEC 11674 standard. The problem with this idea is that different IMO text has to be considered, although the meaning of some clauses is the same, end that A.822(19) cannot be ignored. As drafting the standard is a liaison project of ISO and IEC we propose to have a meeting of experts from ISO and IEC after good preparation before the working group goes on. This could also be a chance to decide how safety aspects could be included which are completely missing at present. ISO/TC 8/SC 6 and IEC/TC 80 are invited to consider this proposal.		
Germany (IEC/TC 80)	Other comments	This committee draft does neither comply to ISO/IEC 'Rules for the structure and drafting of International Standards' as given in the DIRECTIVES, PART 3, Third edition, 1997, nor does it take care of the most recent IMO performance standards adopted. Examples : The Scope does contain requirements "shall comply ...", which shall not be the case, and cannot be used as a summary for bibliographic purposes (DIRECTIVES, PART 3, 6.2.1). The third paragraph of the scope refers to IMO resolution A.342(IX), adopted 12 November 1975 without taking note of the fact, that this resolution had been amended by resolution MSC.64(67), adopted 4		Not accepted. Reason : Endeavour has been made so that the contents are in line with the latest IMO Resolution. This time, the proposal is not accepted. However, if you feel dissatisfied, you are requested to point out the details at the second stage of CD

		December 1996, whereby the complete text of the annex containing the performance requirements was replaced. The extracts from IMO resolution A.822(19), which are printed in italics, are not exactly quoted. Changes proposed to the draft standard for heading control systems (ISO/CD 11674), equally applicable to this draft. Have not been incorporated. Etc., etc. This committee draft is not mature and cannot be approved for circulation as a DIS. It is proposed to conduct a meeting of SC 6 in Europe to allow European experts to actively participate and have their contributions included in a revised CD. A possible location could be e.g. London at the British Standards Institute.		